FEDERATED MALAY STATES.

REPORT OF THE DIRECTOR OF AGRICULTURE FOR THE YEAR 1913.

STAFF.

The Department of Agriculture suffered a great loss during the year in the departure of Mr. L. C. Brown, Inspector of Coconuts, who was granted three months' leave from 1st November, prior to retirement. Mr. Brown's official connection with Federated Malay States agriculture dated from 1902, three years before the department, with which his inspection division was afterwards incorporated, was organized.

Mr. C. K. Bancroft, Mycologist, resigned in 1913 and proceeded to British Guiana, where he had been appointed Assistant Director of Agriculture; the position of Mycologist was not filled during the year, but arrangements have been made with Mr F. T. Brooks, Senior Demonstrator in Botany at Cambridge University, to take up the work for a year, commencing early in 1914. Mr. E. Bateson, the First Assistant Mycologist, was occupied very largely with his work on the padi experiments in Krian, so that the greater part of the mycological work fell on Mr. A. Sharples, Assistant Mycologist, who was only appointed at the close of 1912 and took up his duties on 30th January, 1913.

During the year a new Inspection Division was started with the idea of bringing the agriculturists of the country into closer touch with the activities of the head office staff at Kuala Lumpur, especially with regard to pests and diseases. The Chief Agricultural Inspector, Mr. F. W. South, formerly Mycologist to the Imperial Department of Agriculture for the West Indies, arrived on 13th June, and the following Assistant Agricultural Inspectors also took up their duties during the year: Mr. F. de la Mare Norris on 11th April; Mr. A. G. G. Ellis on 3rd June; and Mr. P. B. Richards on 20th June. In the case of known pests or diseases these officers give advice as to treatment in accordance with the recommendations of the Government Entomologist and Mycologist; when the pests or diseases appear to be new, specimens are taken and forwarded to the Agricultural Department for identification and advice as to treatment. At the time of their arrival the Inspecting Officers had no special legal powers, but these were conferred upon them by "The Agricultural Pests' Enactment, No. 13 of 1913," which became law in August, 1913. In accordance with this Enactment a duly appointed Agricultural Inspector can cause any pest or disease to be treated or any insanitary land to be rendered sanitary and can, with the approval of the Director of Agriculture, recover the cost from the owner or occupier of the land.

After the arrival of the Chief Agricultural Inspector, the members of the staff were distributed among the various States as follows:

The Chief Agricultural Inspector has his head-quarters in the Agricultural Department at Kuala Lumpur, where Mr. Norris is also stationed as Assistant Agricultural Inspector, Selangor, Mr. Richards was sent to the Negri Sembilan on 2nd July as Assistant Agricultural Inspector for that State and Pahang, with his head-quarters at Seremban. Some of the work in Pahang will also be undertaken by the Chief Agricultural Inspector. Mr. A. G. G. Ellis was appointed Assistant Agricultural Inspector for Perak North and was also instructed to act in Perak South pending the appointment of the last Assistant Agricultural Inspector. He took up his duties there on 21st July. His head-quarters were placed temporarily at Kuala Kangsar as being more central, though he will ultimately be stationed at Taiping and the Assistant Agricultural Inspector, Perak South, at Batu Gajah.

When the Inspector of Coconuts, Mr. L. C. Brown, went on leave at the end of October, his duties were taken over by the Chief Agricultural Inspector. Mr. Brown retires on 31st January. It may be added here that the Inspector of Coconuts and his two Assistant Inspectors were appointed as Inspectors under the Agricultural Pests' Enactment along with the Agricultural Inspectors.

Mr. N. W. Barritt, Economic Botanist, resigned his appointment on the grounds of ill-health. At the close of the year this post had been filled by the appointment of Mr. G. E. Coombs.

Mr. E. Bateson, Assistant Mycologist, is resigning his position at the end of his agreement in 13th February, 1914, to take up an appointment in British North Borneo.

Mr. J. R. Hill, Government Chemist, attached to the Institute for Medical Research, was transferred to this department as Assistant Chemist. As Mr. Hill proceeded on leave on 1st October, 1913, he did not take up the duties of his appointment during the year. Mr. J. G. Watson, Superintendent, Government Plantation, arrived from England and assumed duties in March 1913; he was afterwards transferred to the Forest Department. Mr. Milsum who succeeded him arrived and assumed duties on 29th November.

For 1914, two additional Assistant Chemists have been approved, whose work will be devoted to problems of rubber manufacture.

The interest taken by Malays in the temporary padi experiments at Krian and Kuala Kangsar has proved that they are quite capable of taking advantage of demonstration work which is brought to their notice. It has therefore been decided to place the experiments on a permanent footing and to put them in charge of new officers who will be styled Agricultural Instructors.

The appointment of a Second Assistant Entomologist has also been approved for 1914.

Mr. B. J. Eaton, Agricultural Chemist, returned from long leave on 14th March, 1913, and Mr. H. C. Pratt, Government Entomologist, on 4th June, 1913. Mr. C. B. Holman-Hunt proceeded on eight months' full pay leave on 11th June, 1913. Messrs. W. L. Swan and J. Bathurst Kerr remained in charge of the Government Rubber Plantations at Pondok Tanjong (Perak) and Kuala Tembeling (Pahang), throughout the year.

The Head Office buildings were completed early in the year and form quite a good block of laboratories and offices. The extra accommodation was urgently required on account of the large increases in staff during the past few years.

The following table shows the total estimated and actual expenditure and revenue of the Department of Agriculture for the last six years. From 1st January, 1913, the Government Plantations at Pondok Tanjong and Kuala Tembeling were taken over from the Forest Department.

EXPENDITURE.

	Estimated.	Actual.
1908	$ 79,315	$ 76,181.00
1909	100,401	90,921.41
1910	111,206	99,835.60
1911	135,142	123,236.55
1912	196,611	171,834.84
1913	337,482	339,989.71

REVENUE.

	Estimated.	Actual.
1910	$ —	$ 20,187.67
1911	16,000	14,842.84
1912	15,000	25,575.11
1913	143,000	100,583.25

In addition there was a special expenditure of $42,217.60 on locust destruction during 1913.

With the retirement of Mr. L. C. Brown, who was also Inspecting Officer, Loans to Planters, the arrangements for carrying out this work have also had to be reorganized. The final organization has not yet been decided on and in the meantime the work is being carried on departmentally.

RUBBER.

The year 1913 was almost as memorable in the history of rubber prices as 1910. Most people interested in the crop had expected a fall in the price eventually to a considerably lower figure than has been realized in the past few years, but very few were prepared for the fall that occurred during the year. The immediate cause of the fall was probably the strike followed by floods at Akron, the chief centre of rubber manufacture in the United States of America, where some 300-500 tons a week are normally consumed. The highest price in London of the year as given by Messrs. Lewis and Peat was 4*s.* 8*d.* in January, the price dropped below 4*s.* in April, below 3*s.* in July, and the lowest of the year was touched in September, namely 1*s.* 11½*d.* After this prices recovered somewhat and the market stood at about 2*s.* 3*d.* at the close of the year.

It is generally expected that a steady market at between 2*s.* and 2*s.* 6*d.* for first grade rubbers will be maintained during the year 1914.

The fall in price, although its rapidity was unfortunate, has not been without its good effects on the plantation industry. Estates throughout the country have overhauled their expenditure, which had perhaps got rather out of hand during the continuance of high prices and considerable economies have been effected in all directions.

Inferior grades of wild rubbers, it is expected, will no longer be able to compete with the cleaner and better plantation product and in fact Messrs. Lewis and Peat estimate that in 1913, a reduction of 3,000 to 4,000 tons in the production of wild rubber had already occurred. With an increasing consumption, even only on past lines, of rubber, the virtual disappearance of inferior wild grades should steady the market for our product. The full effect of this, of course, cannot be seen at once, as stocks of these grades had to be disposed of even at unremunerative prices.

If manufacturers can expect a steady market at about present prices, there is little doubt that fresh uses will be found for rubber and thus the increasing supplies of the plantation product which will be coming forward during the next few years will be absorbed.

The estates that have suffered worst from the rapidity of the fall in price are those which had only a part of their acreage in bearing and had calculated to use the profits on this to carry the younger areas on to the producing stage. With profits falling off on they did, it was impossible to carry out the original programme and at the same time the issue of fresh capital was rendered very difficult. It was even no longer profitable to tap some 4-5 year old areas which had been counted on to yield a fair profit at 3*s.* per lb. The Planters' Loans Fund has been of great assistance to many estates which were in this predicament and the capital of the fund was increased by a further $1,000,000, during the year, but this new capital was only available for private owners and syndicates and local companies.

As already mentioned all round economies were effected on plantations during the year and it may now be assumed that rubber can be produced and placed on board by many estates at 1*s.* per lb. Estates with large areas of older rubber and those favourably situated can produce for less than this, but it is not suggested that the majority of estates will be able to produce even at this price for some years.

The increase in the yields from trees as they mature and the reduction of the number of trees per acre by thinning out will automatically ensure a steady drop in the cost of production on younger estates. This should be increased by a careful and sound economy, but I may be permitted to point out that everything that reduces expenditure is not necessarily economy. In particular to cut down supervision beyond the point of efficiency is no more true economy than it would be to reduce expenditure on weeding to such a point that the trees become smothered in lalang (*Imperata arundinacea*). Proper supervision means so much on a estate, that any reduction in expenditure under this head should be most carefully considered. Economy in manufacture also seems to me to be carried out on wrong lines, small buildings are often put up when an estate is coming into bearing, which must obviously be scrapped in a year or two and all work is done by hand. Provided that money is available it would seem sounder economy to plan from the first for the future requirements of the estate.

ACREAGES, PRODUCTION, ETC.

The fall in the price of rubber has naturally not been without its influence on the area planted up during the year, which is the smallest recorded since 1909. In the Federated Malay States only 34,127 acres were planted against 54,105 in 1912; 107,200 in 1911; and 48,821 in 1910. The increase is, however, larger than might have been expected and shows that some investors recognize the real soundness of the industry. In Selangor the new area is nearly as great as it was last year, 24,100 acres as compared with 24,500. In Perak the increase is very small, only 2,300 acres as against 16,300 in 1912; in Negri Sembilan the figures are 7,200 acres compared with 11,900; only 420 acres have been opened in Pahang. Selangor, therefore, maintains the position of having the largest rubber acreage, nearly 195,000 acres compared with 142,000 in Perak and 86,000 in Negri Sembilan.

The rubber acreage producing in the Federated Malay States is returned at 164,390 acres, an increase of about 28,000 acres over the preceding year. The average yield per acre works out at 275 lbs. and when it is considered that about one-fifth of the whole bearing area has been taken in during the past two years, it will be granted that an estimate of 400 lbs. per acre from rubber in full bearing is not too optimistic.

The rubber output from estates in 1913 is returned at 20,226 tons as compared with 14,193 tons in 1912. The increase is thus about 42 per cent. The rubber exported from the Federated Malay States during 1913 is given me by the Commissioner of Trade and Customs as follows, inclusive of re-exports:

Perak	7,659 tons.
Selangor	11,883 „
Negri Sembilan	$3,995\frac{7}{10}$ „
Pahang	$181\frac{9}{10}$ „
Total ...	$23,719\frac{6}{10}$ „

These figures show that the Federated Malay States produced again just over one-half the world's total of plantation rubber as given by Messrs. Lewis and Peat—47,000 tons.

The difference between the "export" and "output" is doubtless due to the production from small holdings which is not included in my figures and that of estates which have failed to send in their returns.

The percentage increases in output from the four States are approximately :

Selangor	37	per cent.
Perak	61	„
Negri Sembilan	36	„
Pahang	100	„

The estate production in Selangor is still some 3,480 tons higher than in Perak which is the next largest producer.

The total estate production of Malaya is returned at 28,214 tons, an increase of 9,266 tons or 50 per cent. over last year. My estimate made in 1910 of an increase of about 7,000 tons has been well exceeded.

The largest increase outside the Federated Malay States comes from Malacca, where the production was doubled during the year. Malacca now follows Selangor and Perak in production.

The total number of labourers employed on estates in the Federated Malay States at the end of 1912 is given as 201,207, an increase of about 13,000 over the preceding year. As in previous years, Tamils form the greater part of the labour force in Selangor and Perak; in the former State they number 76,000, out of a total of 87,000, while in Perak they number 48,000, out of 72,000 of all races. In the Negri Sembilan, Chinese form rather more than half the labour force; in Pahang the number of Chinese and Tamils are about equal, each forming about one-third of the total labour force.

During the year a general movement has taken place to do away with the great inconsistencies in the rates of pay between estates in the same district. Good progress has been made in this direction by agreement between estates in the District Planters' Associations, though it is realized that no general action could be taken throughout the country and that exceptionally situated estates must give special terms.

The following table shows the highest and lowest rates paid per day in the four States :

Race.	Selangor.		Perak.		Negri Sembilan.		Pahang.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
	cts.	*cts.*	*cts.*	*cts.*	*cts.*	*cts.*	$ *cts.*	*cts.*
Tamil (men)	50	27	50	30	50	28	65	25
Javanese ...	50	33	50	25	55	26	50	35
Chinese ...	90	50	90	40	90	52	1 00	60

The above figures are from estates over 100 acres in extent.

They show that some improvement has been made towards levelling the rates since last year and it is expected that further improvement in this direction will be seen as the benefits to planters by co-operation of this kind are realized.

At the close of the year the total area planted in rubber in the Federated Malay States amounted to 433,324 acres as compared with 399,197 acres in 1912. In both these years only areas of 100 acres and over are taken into account. In the Straits Settlements the total area under rubber has increased from 94,263 acres at the end of 1912 to 111,316 acres in 1913. In the non-federated States, the acreage has increased in the same period from 128,161 to 163,905.

The total area under rubber, therefore, in Malaya, at the close of 1913 amounted to 708,545 acres, of which only 213,419 acres were in bearing at the end of the year and only 165,566 acres throughout. The average yield works out at over 290 lbs. per acre, which as before is rather higher than the average for the Federated Malay States alone. The total estate output for the whole country is, approximately, 28,170 tons, a figure which shows close agreement with the estimate in my last report of 27,000 tons. If we estimate again that the whole area planted up to 1909 will be in bearing in 1914, the estate output for Malaya for that year should be about 36,000 tons.

CULTIVATION.

The reduction in the price of rubber has increased the tendency noted in my last year's report in favour of wider distances for planting. Planters have to look forward to the time when it will probably not pay to tap trees until they reach their sixth year or even later; to set out a number of extra trees that will have to be removed a year or so later than this is therefore hardly justifiable. It is also being recognized that trees originally planted at wide distances are much more satisfactory, as regards growth and yield, than those planted closer and eventually given wider spacing by thinning out. The general view now is that not more than 100 trees should originally be planted to the acre and that eventually about 40 or 50 to the acre should be left. A number of influential planters even favour planting originally not more than 50 trees to the acre.

The change that has occurred since a few years ago, when 180—200 trees were usually planted and when 100 trees per acre was regarded as the proper or even ideal number to work to, is quite remarkable.

Catch-crops are still in little favour and no planter will adopt this form of cultivation if he can avoid it. Robusta coffee does not grow well everywhere and the prices that this grade has secured during the past year have not been altogether satisfactory. A really remunerative catch-crop for rubber would appear to be very difficult to secure.

In the Federated Malay States only some 10,891 acres out of a total of 433,324 is interplanted with catch-crops and of this coffee occupies about 4,906 acres. The proportion is thus about 2.3 per cent.

In the Straits Settlements the area is 9,164 acres out of a total of 111,316, giving a proportion of about 8 per cent. as against 9 per cent. last year.

Indigo which was mentioned in my report for last year as a possible catch-crop has not proved a success, although tried on both the hill land at Kuala Lumpur and the alluvial soils near Telok Anson.

A number of other coffee varieties are being experimented with, as are also ground nuts, soya beans and a number of other possibly revenue producing crops. These will be referred to in the report on Experimental Plantations. If wider planting and later production of rubber is to be the rule in future, a remunerative crop that could be grown between the young trees would be of great assistance.

Cover-crops that are not revenue producing are also very little in favour among Federated Malay States planters, though a tendency to use them on steeper hill-sides is to be noticed. The advantages that might be expected to be given by the use of a good cover-crop are as follows:—(1) Improvement of soil texture by the incorporation of the humus derived from the cover either from the leaves only or the whole crop if this is regularly turned in; (2) Reduction of the loss of surface soil on hilly lands by wash during the heavy rains common all through the year in Malaya; (3) Reduction in the cost of weeding; (4) An addition to the soil nitrogen if leguminous covers are used. With all these advantages it seems surprising that so few attempts are now made to use a cover-crop of any description, and the reasons are, I think, that in the earlier days of rubber planting unsuitable covers were tried and they were expected to do far too much.

They were expected to keep down the weeds altogether, which they were quite incapable of doing, with the result that the whole area got in a thoroughly weedy condition, and many of them cost far more to clean up than it would have done to have kept them clean from the beginning.

If proper covers are used and they are properly looked after, there is no need for anything of this sort to happen, but it must be remembered that they do require attention particularly with regard to weeding. The horse gram (*Dolichos biflorus*) has continued to give good results on the experimental areas and has been tried on a few estates; the Sarawak bean, mentioned last year, appears to be an excellent close low-growing cover and is worth special trial, specimens of this were sent to Kew and it proved to be a new species, it has since been described and named as *Dolichos Hosei*. Passion flower (*Passiflora fœtida*) and sweet potato are used on a number of estates, the latter particularly on damp localities.

A number of other covers are being experimented with and will be mentioned later in the report.

Cultivation of the soil as distinguished from the standard clean-weeding is being adopted on a good many estates. The results have been in most cases satisfactory. In this connection an interesting series of experiments has been started at Castleton Estate, Telok Anson, to test the cost and effects of different systems of cultivation on this type of soil, combined with tests of cover-crops. Experiments in the use of dynamite for cultivation have also been made at Kuala Lumpur and at Castleton, and assistance has been given to a number of estates which were also experimenting.

After Mr. Eaton's return from leave it was found possible for Mr. Barrowcliff, first Assistant Chemist, to devote himself specially to soil work and especially during the second half of the year considerable progress was made in the study not only of rubber but of coconut, padi and other soils. Whenever possible the Chemist collects the soils himself in order to become acquainted with the cultural, physiographical and other features of the area he is to report on.

All of the rubber soils examined were from estates requiring advice as to the arrangement of manurial trials or the treatment of backward areas. The fall in the price of rubber has caused a set back to the employment of fertilizers, but it is probable that this is only temporary and that this branch of the work will become of considerable importance.

Two sets of manurial experiments are being conducted at Kuala Lumpur Experimental Plantation, one on young trees and the other on trees that have been in bearing for some years.

An extensive series of experiments has also been started at Castleton Estate, Telok Anson. They have been planned to ascertain the effect of lime, nitrogen, potash and phosphate in all combinations and to test also the difference due to applying them in the various forms in which they are purchasable, as for instance burnt lime against lime-stone, basic slag against superphosphate.

Each plot is of two acres, composed of trees of uniform age and girth. Results will be expressed in the first year in terms of increase of girth, later as yields of rubber. The experiments as established are to be permanent, the manures being renewed every two years in order that ultimate effects renewal of bark, quality of rubber, etc., may be observed.

In another year's time the knowledge that will have been acquired of the types of soil best suited for the staple cultivations of the country will justify the commencement of survey work of the agricultural possibilities of the districts now being opened up by railway and road development, so that information of great value will be available for companies and individuals proposing to start work in these localities.

Tapping continues to receive attention and is a subject that usually comes up for discussion whenever planters, especially if from different districts, meet. It is very seldom now that one sees more than two cuts on a quarter of the circumference or an equivalent number extending over one-half the circumference; the contrast to three years ago, when it was quite common to see three times this number of cuts per tree, is evidence of the great progress that is being made in the sound conduct of estates. The experiments at Kuala Lumpur continue to give most interesting results, which are greatly appreciated by planters. Progress reports are published from time to time in the *Agricultural Bulletin*.

The "opposite quarter" system, which I stated last year to have given the poorest results, continues to do so. This system is now practically abandoned on estates, experience generally having confirmed our experiments.

Also in agreement with our experimental results, the favourite system in practice for opening up young rubber is the "basal V" which has been found to give by far the highest yields for the first year of tapping and which has so far given no evidence of any ill-effect. Opinions differ as to whether the "V" system should be continued or whether after the first year the "single quarter" system should be adopted. So far as our experiments go they favour a continuance of the "V" but a definite pronouncement cannot be made for some time yet.

Another interesting experiment is that which shows that there is actually less rubber produced, during the first 12 months, from three cuts on the quarter system than from two. The folly of the old excessive tapping is thus emphasized.

The favourite tapping question for discussion among planters is whether this should be done every day or on alternate days. Unfortunately this is a question that can only be settled by experiment for each plantation and can never be finally settled until the price of rubber remains fairly fixed.

The age of the trees and their yielding capacity, the cost of labour and its efficiency and above all the price of rubber are all points that must be calculated out before a decision can be arrived at.

Our experiments show consistently that for the same amount of bark removed, the total yield is greater where every day tapping is practised, but that the yield per tapping is greater when this is done on alternate days.

It is clear therefore that if the cost of production per lb. of rubber is alone to be considered, the manager will undoubtedly select the alternate day system, incidentally he will, of course, postpone tapping his trees at all as long as possible. I would take this opportunity of emphasizing the fact that it is not the profit per pound of rubber produced that alone should be considered, but the profit made per acre and too much insistence on the reduction in cost per lb. of rubber produced is therefore dangerous.

If by tapping 5-year old trees on a reasonable system a profit is made, these trees should be tapped. Similarly if by tapping every day, so much extra rubber is produced that it shows a profit on the extra cost of tapping, etc., then every day tapping should be adopted. As I have already said this can only be settled by careful experimenting and calculation by every individual estate and even then it is likely to vary from year to year. It may generally be said, however, that the older the trees the greater are the increases from every day over alternate day tapping.

MANUFACTURE.

There has probably been more discussion and writing about the subject of plantation rubber manufacture than during any period since the beginning of the industry. The steadily falling price of the plantation product and the disparity in price between this and "fine hard Para" brought forward innumerable suggestions and theories to explain the supposed inferiority of the plantation product.

What manufacturers do complain of as regards plantation rubber is not that it is not good, but that it is not uniform as regards the qualities on which they depend in the manufactured article; each lot of plantation Para they buy has to be treated differently from the last lot, otherwise their final product is not of the same quality.

The number of factors which may influence the quality of rubber are extremely numerous, and no one can say at present which of them are and which are not effective. Obviously the first thing to be done is to study every one of these factors separately, determine which of them are influential, then see whether any or all of them can be eliminated in estate practice.

To meet this need the Federated Malay States Government has now established an experimental vulcanizing and testing station in Kuala Lumpur, which was practically completed at the end of the year and which is now in running order under the supervision of Mr. Eaton, the Agricultural Chemist. This station is fully equipped and is one of the most complete in existence. I would like to point out again here that the work to be undertaken at the station is purely experimental and that at present no attempt is to be made to undertake the commercial testing of samples, though it is possible that this may be a future development. When the full staff of Chemists is at work, it is hoped to secure the co-operation of a number of estates, which will prepare their rubber according to the requirements of the Chemists, who will afterwards test it. This work again will be entirely of an experimental nature. Until we know what are the causes underlying the variability of plantation rubber and can tell to what extent these can be overcome, it seems somewhat premature to establish a commercial testing station. The problem is an extremely complicated one, much more so than appears at first sight, and it will probably be years before the full value of the work to be undertaken here can be realized.

It is at any rate satisfactory to record that the first step has been taken and that real work on the fundamental problem of rubber manufacture has been started.

Generally speaking much more care is being taken on the larger and better equipped plantations to keep their methods and products as uniform as possible, but it is regrettable that methods on many estates are still so haphazard.

Derry Rubber.—During the year, two further series of experiments have been carried out on the Derry machine and batches of 200 lbs. and 75 lbs., respectively, sent to America for tests at the request of firms interested in the process. No reports have however yet been received.

Special experiments have been continued on the direct smoking of latex in shallow trays which appears to be promising. These samples will be tested before continuing the experiments.

A "Jackson" smoking cabinet was installed and it is intended to investigate this process, which is, at any rate, rapid.

The Byrne process will also be experimented with.

The new drying house designed by the Director of Agriculture and the Acting Agricultural Chemist was completed and is working satisfactorily. It is intended however to substitute a more efficient exhaust fan. The new factory, which was originally a store, was completed about the end of the year and is now working satisfactorily. This factory was placed under the supervision of the Agricultural Chemist on completion, and various methods have been adopted for its more efficient working. Although the daily amount of rubber to be manufactured is not large, the work is considerable, as a large number of tapping experiments are being carried out and each lot of latex has to be coagulated separately and the rubber machined separately. By measuring the latex from each experiment, coagulating an aliquot measured portion and calculating the rubber content, it is now possible to bulk the latex from each experiment and thus prepare a more uniform rubber for market purposes. This has effected also considerable economy in time.

The latex is now also collected pure and dilution with water to a fixed standard effected in the factory, the dilution being controlled by an hydrometer. In this way first quality latex which is made into smoked sheet always yields a uniform sheet.

Latex Density Experiments.—A large number of specific gravity experiments were carried out during the year on latex, from which it has been possible to have a suitable latex hydrometer constructed. This instrument is now sold by Messrs. J. J. Griffin and Sons, London, and should prove useful for factory controls. A note on the instrument has been inserted in the *Agricultural Bulletin* and the Agricultural Chemist is now preparing tables to be issued with the instrument. A number of experiments were carried out to test the comparative value of formic and acetic acids as a coagulant for Hevea latex. If the rubber coagulated by means of formic acid proves equal to that prepared by the use of acetic acid, after bing vulcanized, the former should be substituted as a coagulant, since it is now cheaper and more economical as a coagulant. It should be considerably cheaper, but I have been informed by the firm which first imported the acid into this country as a coagulant that the higher local price is due to the high freight charged by the steamship companies, as the acid is considered dangerous cargo; this is probably due to the fact that it corrodes the cork of the vessel in which it is contained.

Estate Samples of Rubber.—Only a few samples of rubber showing special defects have been received from estates. These have included principally samples affected by fungus "spots" which were dealt with by the Mycologist and samples containing "blisters," "pock" marks or air bubbles due to faulty methods of coagulation in respect to strength of coagulant used, excess of coagulant or too concentrated latex. One interesting case of "spot" disease, which subsequently received ample confirmation, was a sample containing orange spots and which on microscopic examination showed a large number of spores with short hyphæ giving an appearance of arrested development. The sample in question was stated to be perfectly dry when despatched, but had become damp subsequently during the voyage probably by contact with sea water. A few samples of tacky rubber were received from one estate. Although no direct evidence was obtained to show the cause of this tackiness, it seems probable that it might have been caused by brass from over heated bearings on the machines. The machines in question were the worst the Chemist had seen on an estate, and since the installation of new machinery, the trouble has, I understand, ceased. Samples of rubber prepared at the Agricultural Department during 1911 on which the labels were affixed by means of brass split pins have in every case developed tackiness on the portion in contact but the tackiness has not spread; this tackiness is more marked in the case of sheet than crepe probably owing to the greater acidity of the former, but possibly because the amount of contact was greater in the former case. These results show the necessity of avoiding contact of raw rubber with copper or its alloys as well as the salts of the metal.

A more thorough investigation of the problem of tackiness will be made, although as far as I am aware, it is at present not a matter of vital importance, if care be taken in the collection of latex and preparation of the rubber. One important point, however, which does require investigation is the probability or otherwise of infection of latex with copper salts in the spraying of trees affected by "pink disease" with Bordeaux mixture.

At the beginning of 1913, judging from the number of specimens sent in, the "spot" diseases of plantation rubber were still very troublesome. A bulletin by Mr. Bancroft had already appeared but further work was necessary to extend our knowledge of these troublesome discolourations, and so a detailed investigation was made by Mr. Sharples. The results of this investigation were published in the form of a special bulletin early in 1914.

INSECT AND OTHER PESTS.

Of the insect pests of rubber reported *Xyleborus parvulus* is the only one that requires mention. This little beetle is very closely related to the shot hole borer of Ceylon (*Xyleborus fornicatus*) and it bores into the trunk or branches of rubber trees. In the majority of cases seen and recorded the tree attacked is diseased, usually being affected by a fungus. There are, however, some instances where quite healthy trees are bored. An examination of these shows that the borer does not often succeed in passing the latex bearing layer. A favourite point of attack is the fork of a tree, or, where pruning has been badly done and the branch not cut off flush with the trunk, here *Xyleborus* will frequently gain an entrance. The low-lying lands thickly planted seem most subject to attack, especially where the trees are being thinned out. In the case of those trees where the primary cause of attack by *Xyleborus* is due to a fungus it is advisable to cut the tree out and burn it. Where *Xyleborus* attacks a healthy tree application of tar over the affected part should be tried and if unsuccessful arsenite of lead might be used.

A good deal of damage is caused in various parts of the Malay States through the attacks of elephants, deer, porcupine, rats, pigs and in a few cases by monkeys. Notes on these will appear later in the *Agricultural Bulletin, Federated Malay States.*

FUNGUS DISEASES.

During the above period the diseases of *Hevea Brasilensis* gave little trouble with the exception of Pink disease. This disease, due to *Corticium salmonicolor* (B and Br.) is very common in certain districts of the Federated Malay States, and is by far the most important disease upon rubber trees in Malaya. Attention was directed to the importance this disease had attained early in 1913 but nothing could be done until the beginning of 1914, when on the arrival of the Mycologist, Mr. Brooks' work was immediately commenced with a view to a thorough investigation of the disease.

Die-back (*Diplodia cacaoicola*) was often met with but was never troublesome. An interesting observation was made where this fungus was attacking basket seedlings of Hevea at the collar and killing them out.

Bark-canker due to *Phytopthora faberi*, a common disease in Java and Ceylon was not met with during 1913 in the Federated Malay States. All estates sending in specimens of diseased bark which showed symptoms at all comparable with those of Bark-canker were visited, and a careful examination of the diseased tree made *in situ*, but no case typical of this disease was found.

Root diseases have given little trouble during the year. *Fomes semitostus* (*Berk*) the common root disease was responsible for much damage on one or two estates where local conditions favoured the spread of the fungus. Two estates were visited which showed especially well how dangerous *Fomes semitostus* can become if neglected.

Brown root disease (*Hymenochaete noxia*) was occasionally met with killing individual trees on young plantations.

RUBBER EXHIBITION.

A Rubber and Allied Trades Exhibition is to be held in London in June, 1914, and it was agreed that in the present position of the rubber industry it would be advisable to participate. The Federated Malay States Government promised to support the exhibition and organize and exhibit from this country if the Planters' Association of Malaya would guarantee contributions to the amount of £1,000. The guarantee was forthcoming in November, 1913, and arrangements were therefore made to participate. As in the case of the New York Exposition of 1912, the arrangements in London will be in charge of the Malay States Information Agency, and on this side the organization has been left to me. It is hoped that an exhibit as effective as that sent to New York will be forthcoming.

COCONUTS.

The Chief Agricultural Inspector estimates the total area planted with coconuts in the Federated Malay States at 174,234 acres, showing an increase as compared with 1912 of 16,634 acres. Of this total only 40,175 acres is returned as from estates of 100 acres and over, so that by far the greater part of the coconuts grown in the Federated Malay States are on small holdings. The estate cultivation shows a very large increase, however, the figure given above being nearly 10,000 acres higher than that for 1912.

The coconut areas are divided as follows :

State.	District.	Area.		Increase.
Perak	Lower Perak ...	... 54,349		... 8,412
	Kinta	... 5,521		... 387
	Batang Padang ...	... 1,703		... 147
	Larut and Matang ...	... 7,293		... 122
	Kuala Kangsar ...	... 6,467		... 212
	Upper Perak ...	... 489		... 32
	Krian and Selama ...	... 14,842		... —
			90,664	
Selangor ...	Klang and Kuala Langat ...	21,800		... 4,000
	Kuala Selangor and Bernam	16,113		... 1,173
	Kuala Lumpur, Ulu Langat and Ulu Selangor ...	5,648		... 65
			43,561	
Negri Sembilan	Seremban	... 3,827		... 55
	Jelebu	... 2,599		... 95
	Tampin	... 5,629		... —
	Kuala Pilah ...	... 5,748		... 80
	Coast	... 3,072		... 50
			20,875	
Pahang ...	...	... 19,134	19,134	1,772
			174,234	16,634

The estate cultivation is divided as follows among the four States :

Perak	24,611
Selangor	11,320
Negri Sembilan	1,892
Pahang	2,352

It will be noticed that Lower Perak more than continues to hold its position as the premier coconut district of the country, though both the Kuala Langat and Kuala Selangor districts of Selangor are rapidly increasing their acreages.

Prices for copra and for nuts continued to be very satisfactory during the year, and it is noted that the native copra in Perak shows a marked improvement being cleaner and of a better grade.

The following table kindly supplied by the Commissioner of Trade and Customs shows the export of copra from the four States during the year and the increase over 1912:

COPRA.

State.	Export pikuls.	Increase pikuls.
Perak	120,860	21,036
Selangor	32,696	5,193
Negri Sembilan	660	296
Pahang	1,817	67
	156,033=9,264 tons.	26,502

The increase is therefore about, 1,500 tons over last year.

It will be noted that the four districts showing the largest areas under coconuts, Krian, Lower Perak, Kuala Selangor and Kuala Langat are all on the west coast and the coconut plantations are almost confined to the alluvial coast plain on this side of the country. There is much good land available in Pahang, but transport difficulties have so far prevented much of this from being utilized. As this State is being opened by roads and railways it is hoped that further agricultural development will follow and especially with coconuts.

One point should be emphasized and that is that coconut properties cannot be developed on the lines that became too common in this country during the rapid development of the rubber industry. In dealing with coconuts, efficiency and economy should never be sacrificed to rapidity. Neglect of this rather obvious warning has caused a certain amount of financial trouble on a few estates.

Coffee is grown with some success as an intercrop with coconuts, nearly 2,600 acres being returned as under coffee and coconuts from estates out of the total of 40,000. The Liberian variety can quite well be grown with coconuts and at present probably pays better than the robusta. It is possible that some of the new varieties allied to robusta may prove more successful.

Mr. Barrowcliff has commenced an investigation on the soil conditions governing the fertility of the coconut tree. Whereas rubber grows well and affords satisfactory yields on almost any class of soil in which it is planted the coconut is much more fastidious. In some places a yield of 20 nuts per tree each year may be taken as the average, in others it reaches 80 or even 100 nuts per tree.

Increasing attention is certain to be paid to this cultivation in the near future and any obtainable information which will enable an estimate to be made of the probable quality for this purpose of a given soil cannot fail to be of value to intending cultivators. The investigations should also give information of value as regards manurial and cultural treatment of existing plantations.

Work in 1913 was confined to districts of noted fertility and will be extended to others where the yields are low. The Bagan Datoh (Lower Perak) soils have been investigated, analyses have been made of a number of soils from the east coast and others from Kinta and Kuala Kangsar have now been dealt with.

There being at present no Government Coconut Plantation experiments in soil treatment, cover-crops, etc., cannot be undertaken.

PESTS AND DISEASES.

The most serious pest of coconuts during the year has been the rat. Large numbers of this beast appeared about the middle of the year in the Bagan Datoh district and did considerable damage to the young areas, eating the terminal bud and so destroying the trees. The erratic habits of this pest and its enormous breeding capacity make it extremely difficult to deal with over such a wide area. Numbers of experiments with virus, traps and poisons were tried, without giving promise of any great success. At present the chief hope seems to be in the protection of the individual trees by tin or zinc jackets, and this will be tried on some estates during 1914.

Other pests were of minor importance. The coconut skipper, *Hidari irava*, caused some trouble during the year, but was kept under by the attacks of a small hymenopterous insect. In other parts coconuts were attacked by "bag worms" (Psychids) which were also kept under by parasitic insects. *Brachartona catoxantha* caused some damage in Krian.

Coconuts have been comparatively free from fungus diseases. Bud-rot, a dangerous disease in other coconut growing countries has not yet been reported in the Federated Malay States. A new disease of young coconuts was found caused by a species of *Helminthosporium*. The fungus was attacking young trees about eighteen months old and was growing vigorously, especially in the nursery; it was also causing much damage in the field. The fungus grows in the hollows formed by the junction of the leaflet and the rachis, forming superficial black patches. These never extend outwards on to the leaves but remain confined to the neighbourhood of the rachis. Cutting out of the diseased leaves and spraying with Bordeaux mixture eradicated the fungus.

INSPECTION AND LOCUSTS.

As already mentioned a division was started during the year for the general inspection of agricultural lands, which, in 1914, will absorb the Coconut Inspection Division, which has done such good work under the control of Mr. L. C. Brown. Mr. F. W. South is in charge of the new organization.

From some points of view it was fortunate that the division was started just as work on a large scale against the locust pest was commenced.

During the early part of the year no active steps were taken to deal with the locust, as it was hoped that the natural conditions of the country, particularly its heavy rainfall, would eventually check its multiplication. These hopes proved to be illusory and the locusts continued to increase and spread rapidly, until the whole of the Negri Sembilan and the inland districts of Selangor were infested.

When Mr. Pratt, the Government Entomologist, returned from leave in June, therefore, it was decided that an active campaign should be started. Mr. Pratt spent nearly two months in Seremban with the object of devising a practicable method of destruction.

As soon as methods were available a large grant was voted for the work and a special organization was built up working under the Agricultural Inspectors in the two infested States.

After his preliminary experimental work, the Government Entomologist was able to devote his time to a study of the life-history of the insect both in the laboratory and in the field. A paper on this has been prepared and is awaiting the arrival of coloured and other plates for publication.

Experiments with poisons were tried during November and December and it was found that arsenite of soda with molasses was effective. It is expected that this will prove a useful alternative to the trap method of destruction, especially in dealing with small swarms and with swarms in places where driving is attended with special difficulty.

It is interesting to note that the locust has not yet been identified with any certainty, except in so far that it is a species of *Pachytylus*. There is still also no information as to the origin of this invasion.

The work of the Inspection Division may be summarized as follows:

The office of each of the Assistant Agricultural Inspectors in Seremban and Kuala Kangsar as well as that in the Agricultural Department, Kuala Lumpur, has been supplied with furniture and with a small supply of laboratory apparatus such as is necessary for making a preliminary examination of diseased material, and for forwarding preserved specimens through the post. This includes a compound and a dissecting microscope and in addition a quarter plate camera. Drafts were prepared of the various notice forms required under the Agricultural Pests' Enactment and when these have been approved and printed a supply will be kept in each office.

Work in Perak.—In June the Chief Agricultural Inspector and Mr. Ellis spent some days in preliminary attempts to destroy the rats that were causing very serious injury to young coconuts in the Bagan Datoh district. Subsequently, on the retirement of Mr. Barritt, the Government Botanist, Mr. Ellis took charge of the padi experiments near Kuala Kangsar. When these were duly started, he devoted his attention to the inspection of estates and small holdings, particularly in relation to the distribution and control of "pink disease" of rubber which was spreading rapidly and proving a serious pest in one or two districts. In all forty estates were visited, several more than once, as well as numerous small holdings.

In addition to pink disease, by far the most important at the present time, *Fomes semitostus* was found to be of general distribution on rubber estates, while instances of brown root disease, *Hymenochaete noxia*, and of die-back were recorded. Burrs were also giving considerable trouble on the rubber in certain districts.

Among insects the nettle caterpillar did a certain amount of damage to young coconuts in one locality.

Work done by Chief Agricultural Inspector and Assistant Agricultural Inspector, Selangor.—The Chief Agricultural Inspector spent much time in July, August and September in helping the Government Entomologist, firstly with the work of locust destruction and subsequently in selecting and organizing the staff appointed in accordance with a scheme prepared by these two officers which received the approval of the Government on 16th August. A considerable amount of time was also occupied by the Chief Agricultural Inspector in the work necessary for the proper organization and equipment of the Assistant Inspectors and in travelling both in this connection, and in connection with the supervision of the work of locust destruction. At the end of the year this officer was also engaged in visits of inspection in connection with the Government Loans to Planters.

During June and July, the Assistant Agricultural Inspector, Selangor, assisted the Government Entomologist with the preliminary experimental work on locust destruction in Negri Sembilan and subsequently with the work of destruction. When the special staff for this purpose were appointed in September, that portion of it in Selangor was placed in charge of the Assistant Agricultural Inspector so that for the most of the year the locust work has formed his chief duty.

Two estates were visited in November in the course of inspection work and a beginning was made with the necessary preliminaries. In December, Mr. Norris exchanged duties with Mr. Richards in Seremban in consequence of the ill-health of the latter.

Work in Negri Sembilan.—Mr. Richards' duties were confined entirely to the work of locust destruction as he also assisted the Government Entomologist in the months of June and July, and subsequently in August took charge of the whole organization of the work in his State. In addition, he obtained an office and arranged his equipment. Ill-health handicapped his work in November and he came to Kuala Lumpur in December to do more office work and less travelling as a temporary rest.

All the Agricultural Inspectors have now obtained a good knowledge of the geography of their respective States and have made a commencement in acquiring a knowledge of the language.

Work Contemplated.—Next year it is intended to teach all the Sub-Inspectors of Coconuts how to recognize and treat the well-known diseases of rubber and then to use them in the inspection of small holdings, those containing rubber as well as those planted with coconuts. In this way it is hoped that much can be done to secure proper treatment of pink disease on all infected small holdings. It is against this disease in particular that efforts will be directed.

It is also anticipated that a good start will be made with the routine work of estate inspection more especially in Perak and Selangor; the locust work in Negri Sembilan may form a serious handicap to estate inspection as there is only one man to do both; in Selangor the Chief Agricultural Inspector and Assistant Agricultural Inspector can divide the duties.

Both in Selangor and Negri Sembilan, it is probable that locusts will continue to be present at least until the end of the year and that they will require practically continuous attention.

Summary of Locust Work.—The staff appointed to carry out the destruction of locusts consisted of five Special Assistants and number of Tamil and Malay conductors in charge of the cooly gangs. All the appointments were made by 2nd September.

Mr. H. P. Lyford and Mr. I. Peche were stationed in Selangor, and Messrs. B. Wolde, R. D. Tollemache and R. F. McIntosh in Negri Sembilan. Mr. McIntosh was removed from duty at the end of October and Mr. R. C. Keane took his place on 12th November. Subsequently certain of these officers were moved from one State to the other in accordance with the requirements of the work at different times.

The locusts destroyed in Selangor during August, September and October, when hoppers were present, amounted to about 24,753 kerosine tins full, representing approximately, 392 swarms.

In Negri Sembilan the Government Entomologist calculated that during the preliminary experimental work during June and July 159,000,000 insects, in round numbers, were destroyed. During the months of September, October, November and December, when the special staff were at work about 3,490 tins full of insects were caught, representing about 875 swarms.

The number of locusts in both States at the end of the year was very considerably reduced. Full reports on this work have been published from time to time in the *Agricultural Bulletin*.

Except in Perak, where Mr. Ellis has been in charge of the whole work of the State, it will be seen that the Inspectors have been able to do but little of the work for which they were appointed. It is hoped that as progress is made with the locust destruction, they will be able in 1914 to withdraw somewhat from this work and devote more of their time to their regular duties.

PADI.

The following figures, supplied as before by the courtesy of the District Officers, show the position of the cultivation of padi in 1913 :

State.	Acreage under padi, 1912-13.	Acreage under padi, 1913-14.	Yield of padi, 1913.	
			Gantangs.	Bushels.
Selangor	5,476*	5,639*	829,696*	= 103,712
Perak	84,550	81,153*	17,141,026*	=2,142,628$\frac{2}{8}$
Negri Sembilan	28,227	29,018*	4,980,762	= 622,595$\frac{2}{8}$
Pahang	7,620	8,018	1,055,399	= 131,924$\frac{1}{8}$
Total ...	125,873	123,828	24,006,883	=3,000,860$\frac{3}{8}$

The figures can be only approximate and there is very little difference between the two years. The yield for 1913, is appreciably higher in Negri Sembilan and Pahang, but lower in Perak. The average as before works out to about 25 bushels to the acre.

The Krian area remains the only one under a Government scheme of irrigation, but several new projects, large and small, are under consideration. The more important proposals are now reported on by a chemist of the Agricultural Department and by an Engineer before any decision is made as to their practicability.

Mr. Barrowcliff was able to devote a certain amount of time to work on padi soils and the results of the analyses and his conclusions were published in the *Agricultural Bulletin.* Manurial experiments based on these have been initiated and will be carried out in 1914 in the Rembau and Kuala Pilah districts of Negri Sembilan.

Soil surveys of the proposed irrigation areas at Pulau-Tawar and Dong, both in Pahang and at Laiang-Laiang in Perak, were carried out by Mr. Barrowcliff.

Krian Experiments.—During the whole of 1913, the experimental work in Krian was in charge of Mr. Bateson, Assistant Mycologist. As already mentioned, these experiments have now been placed on a permanent footing, and from 1914 onwards they will be in charge of an Agricultural Instructor stationed in the district. Mr. Bateson reported fully on the 1912-1913 experiments and a summary of his results may be given here :

(1) The experiments in reclamation by means of drainage and cultivation gave the following results :

(*a*) At Simpang Tiga the crop was increased by 34 per cent. from 179 gantangs per acre in 1912 to 240 in 1913.

(*b*) At Sungei Bogak the crop was increased by 42 per cent. from 209 gantangs per acre in 1912 to 298 gantangs in 1913.

The padi at Simpang Lima was spoilt by flooding.

(2) The comparative experiments on the different methods of reclamation proved that neither draining, ploughing or liming gave an increase of more than 4 per cent. the first year.

With a small number of plots at Simpang Tiga an increase of 42 per cent. was obtained by cultivating for two years.

(3) Experiments with artificial manures were unsuccessful. In every case the cost of the manures was greater than the value of the extra padi obtained by their use.

(4) In the course of the experiments convincing proof was obtained that the failure in previous years of the crops on the third class land was due to wholesale destruction of the padi by deep water.

Injury from this cause can only occur during a short period, namely the week or ten days after transplanting.

The remedy is simple and consists merely in controlling the water during this period so as to prevent deep flooding.

In the absence of floods, the land on the Siakap Road, when neither drained nor ploughed, was found capable of yielding 350 gantangs of padi per acre. The land in the Simpang Lima district will yield 200 gantangs per acre.

The original problem put to the Agricultural Department was to discover how to make this land yield sufficient padi to pay for planting. This problem may now be considered solved.

* Kuala Lumpur, Kuala Langat, Kinta, Lower Perak and Jelebu districts figures are not available.

Mr. Bateson's conclusions have received unfortunate corroboration from the 1913-14 experiments on the Siakap Road. As a result of heavy rains the plots were badly flooded at the critical period, with the result that it is not expected that most of the plots will yield sufficient padi to pay for reaping. This is on the same land that was proved capable of yielding 350 gantangs per acre in the preceding year.

KUALA KANGSAR EXPERIMENTS.—In continuation of the scheme instituted in 1912, padi experiments were carried out at Kuala Kangsar during the season. The results of the first year's work were published in the *Agricultural Bulletin*, Volume I, No. 9, by Mr. Barritt.

The experiments were instituted for the purpose of studying padi cultivation and of obtaining accurate data concerning different varieties of padi, as a basis for seed selection.

The work was again carried out on a block of land at Talang, Kuala Kangsar, belonging to His Highness the Sultan of Perak.

The season under review has not been without its drawbacks in respect to the carrying out of the experiments. Mr. Barritt, the Economic Botanist, had unfortunately to resign his appointment on account of ill-health and consequently the work suffered by having to be taken over by another experimenter. Mr. Ellis, the Agricultural Inspector, Perak North, undertook the supervision of the experiments for the remainder of the year.

VARIETIES.—Early in 1913, samples of 19 varieties of Javanese rice had been selected for trial in Kuala Kangsar. They had been badly stored with the result that they got mouldy and not a single seed germinated. This was particularly unfortunate for although several were awned varieties, they were all excellent samples.

CULTIVATION.—The land was first of all worked with the "tajak" and the herbage allowed to wither and thereafter "hoed" and flooded. Ploughing was done a week later, after the lumps had broken down a bit and the soil puddled by the "giling" and "sikat," finally being made as level as possible by the "giling," so as to get an even depth of water all over the plot.

In order to create greater interest among the Malays they were allowed to treat a small plot in their own way. They first flood the land then tajak it and very soon plough it up, trampling in all grass. The padi on this plot seems as good as on any other plot, but the weeds were far more numerous.

TRANSPLANTING.—Last year it was observed that several plots were ruined by rats and birds. To get over the difficulty, each variety was planted out in a number of small plots some distance apart. This method also largely does away with any effect due to soil or water conditions.

A space of six feet was left between each plot. This was done with a view to preventing, as far as possible, cross fertilization.

When the padi was about 40 days old the plants were taken from the nurseries to the plots. The Kuala Kangsar Malays, unlike those in Krian, do not make a secondary nursery before planting out into the field. Neither do they approve of the method of planting out as advised by Mr. Barritt, that of placing two plants in one hole 9 inches apart. Various numbers of plants at varying distances apart were put forward by the Malays as being best and as they were evidently interested several plots were laid out thus. Up to the present there is no plot appreciably better than the others.

The varieties were sown out at different times, according to their growing periods, so as to ripen all about the same time, the time being about the usual local harvest time. On account of the celebrations connected with the investiture of His Highness the Sultan with the G.C.V.O. at Kuala Kangsar, the local Malays were later than usual in planting this season, with the result that the padi in trial plots is further advanced than the surrounding padi and is now being badly attacked by rats and birds.

VERMIN.—Vermin has accounted for a lot of padi this year in trial plots. In the early stages "Ulats" (padi borers) and tortoises did a great deal of damage. As the result of the following experiment infected padi was successfully treated but not before much had been destroyed.

The water in the bendang was first of all run completely off. Fresh water was allowed to enter and flood the land to a depth of about $2\frac{1}{2}$ inches. While the fresh water was flowing in, a little Jeyes Fluid was continually dropped into it. Later on a stronger solution was made and sprinkled on to the padi. This has been very effective, but of course the solution must be weak.

Birds and rats have done considerable damage when the padi was in flower and of course later on also.

OBSERVATIONS.—On my first visit to the padi land at Talang, I noticed that one piece of land was covered with more weeds than the others. I found that this plot in the previous season had been changkolled only and not ploughed after.

Another piece of land had been hoed and ploughed in April and again in August. This plot has been much more free from weeds than of any other, and besides the padi is taller and the tillering power better than the same varieties in the other plots. This padi is also further advanced and will ripen somewhat earlier.

Conclusion.—These experiments in Kuala Kangsar may be considered to justify the time and money expended on them, as the Malays of the district are really interested and already have asked to buy seed for the coming season.

This part of the report cannot be concluded without an expression of gratitude to the District Officer, Kuala Kangsar, who so willingly assisted with, and took so great an interest in, the work of the experiments generally. The co-operation of the District Officer is essential to the success of this sort of experimental work and it is particularly encouraging to those supervising the work to meet with so much assistance and to find so keen an interest taken in the experiments.

COFFEE AND SUGAR.

The estate area under coffee again shows a decline though a small one from last year's figures, there being only 7,695 acres under this crop as compared with 8,609 acres in 1912, and 11,000 in 1911. The unsatisfactory prices realized for robusta coffee and the unsatisfactory growth in some localities probably explain this in part and of course the coffee grown under rubber is shaded out as the trees mature. The greater part of the coffee is grown in Selangor, where the area shows a slight increase. Of the total 7,695 acres, 4,906 acres represents coffee grown as a catch-crop under rubber, and 2,597 acres of coffee under coconuts. There is a certain amount of mixture of rubber, coconuts and coffee.

The area under coffee in the non-federated States remains about the same as last year.

Sugar-cane is now extinct as an estate crop in Malaya.

EXPERIMENTAL PLANTATIONS.

The Experimental Plantations as before remained under the charge of Mr. F. G. Spring, Agriculturist, Mr. Lambourne has been in immediate charge of the Kuala Lumpur Public Gardens and the grounds of the residences of His Excellency the High Commissioner and the Chief Secretary. Mr. W. L. Wood was in charge of the Taiping Gardens and those on Maxwell's Hill.

The following shows the expenditure and receipts from the Experimental Plantations, Kuala Lumpur, Batu Tiga and Gunong Angsi during the year. The expenditure does not, of course, include supervision:

Total upkeep expenditure	$30,399.98
Receipts of rubber sold	23,972.37
„ of other products sold	247.25

The total output of rubber amounted to 17,606 lbs. consisting of 4,196 lbs. smoked sheet; 10,417 lbs. crepe; 176 lbs. smoked crepe; 1,277 lbs. bark shavings; and 1,540 lbs. scrap.

All roads throughout the Kuala Lumpur Plantation were repaired in the early part of the year. The Gunong Angsi bridle-path has been maintained in good order.

All buildings have been kept in good repair. At Kuala Lumpur a fibre factory and carpenter's work-shop were erected and a set of permanent cooly lines at Batu Tiga. At the latter place, a bridge over the river was built by the Public Works Department.

The labour supply and general health of the coolies at Kuala Lumpur and Gunong Angsi have been exceptionally good, but unfortunately the same cannot be said about Batu Tiga.

PARA RUBBER (HEVEA BRAZILIENSIS).

Tapping Systems.—The work referred to in last year's report was continued. The second year's results of one series of experiments conducted at Kuala Lumpur, and another at Gunong Angsi were published in the *Agricultural Bulletin* as well as an experiment originated by Mr. W. J. Gallagher. An article on "Pricking or Tapping" has been prepared and will shortly appear. A comparison is being made to find out the relative amount of rubber obtained from a varying number of cuts on the single quarter system; the results for the first six months have been published.

Among other tests may be mentioned a comparison of every day, alternate week, alternate month, and once a week tapping.

A number of interesting points in the various experiments may be referred to briefly: (1) the opposite quarter system of tapping as compared with the "V" and single quarter continues to give poor results, in addition to this, it is unsatisfactory as regards cost of tapping and tapping utensils; (2) on the single quarter, two cuts on young trees have given considerably more total rubber than three, while for the first six months' tapping the yields obtained from one and from three cuts are, approximately, equal. It would appear that three cuts on young trees is too severe tapping; (3) opening up young trees with a Basal "V" as compared with other systems, is highly satisfactory; (4) in connection with every, alternate day tapping, the former continues to yield more total rubber over a period, but the latter a higher yield per tapping; (5) tapping one day in seven has given remarkably poor results; (6) systems in which the whole of the bark, up to three feet, is removed in two years, are unsatisfactory.

Cultivation Experiments.—This work was commenced at Castleton Estate in the early part of the year, its object being to compare the growth of rubber, and cost of cultivation, in various plots under different methods of tillage of which may be mentioned hoeing and forking at periodic intervals, harrowing and ordinary surface weeding. These cultivation experiments are also being compared with plots in which cover-crops are being grown.

Cover-Crops.—Special attention has been given to this branch of the work. Horse gram (*Dolichos biflorus*) under certain soil conditions has given remarkably good results; it thrives best on fairly heavy loamy soils, but does not show itself to advantage on light laterite. The Sarawak bean (*Dolichos Hosei*) which was introduced into this country last year would appear to be of considerable value, and does well on light soils. Cuttings of this bean have been distributed to a number of planters; it should soon be possible to give an opinion as to the conditions under which it thrives best. Mr. Barrowcliff obtained seed of a large selection of various leguminous cover-crops during a visit to Java. The following is a list of cover plants, in addition to the above, which have been experimented with during the year: *Desmodium stipulacium, Vigna lutea, V. sinensis, Crotolaria alata, C. feruginea. C. striata, C. incana, Canavalia-ensiformis, Clitoria cajanifolia, C. Ternatea, Pueraria phaseoloides, Centrosema Plumieri, Phaseolus semierectis, Tephrosia Vogelii, T. Hookeriana and Canavalia gladiata.*

Manuring of Rubber.—The second year's result of a manurial experiment conducted at Kuala Lumpur was published in the *Agricultural Bulletin*. In this particular soil, one application of manures had good effect for one year only. This is not surprising considering the lightness of the soil and the periodical heavy tropical rainfalls it receives. Judging from the results it would be expected that small dressings of artificial manures, applied at frequent intervals, would be more effective and profitable than larger quantities applied at longer intervals.

In conjunction with Mr. Barrowcliff a series of manurial experiments with young rubber have been commenced at Castleton Estate. The land selected is admirably suited for work of this nature. There are 16 individual plots, each covering an area of two acres. It is intended to continue this work over a sufficiently long period to show, in the first place, increase in girth of the trees, and afterwards yield of rubber. Another series of experiments with 12-year old rubber has been commenced at Kuala Lumpur, and one with 4-year old trees at Batu Tiga.

Rubber on Terraces.—On hilly land, rubber is being grown on terraces, and a comparison is being made, as regards growth with trees on similar land without terraces.

SPECIES OF RUBBER OTHER THAN PARA.

Castilloa Elastica and various species of *Manihot* which were planted last year on Gunong Angsi Hill at an elevation of 1,200 feet have shown remarkably good growth.

PRODUCTS OTHER THAN RUBBER.

African Oil Palm (Elaeis guineensis).—During the year many enquiries were received with regard to the cultivation of this palm in Malaya. An article was published in the *Agricultural Bulletin* on the subject. Seeds have been distributed to planters in various parts of the country. A 15-acre plot of young oil palms, near the Agricultural Offices has shown fairly good growth and should give interesting results in the course of a few years.

Fibres.—The following is a list of fibres planted during the year: Manila Hemp (*Musa textilis*), Sisal Hemp (*Agave rigida var. sisalana*), *Furcraea* sp., *Sansevieria* sp., and Mozambique hemp. An order was placed for modern fibre machinery, and it is expected to arrive in the early part of 1914. It is intended to carry out experiments with the above-mentioned fibres to find out their respective merits in this country.

Ipecacuanha.—This crop is a highly profitable one, but as the demand is small, if cultivated on a large scale, over production would probably result. The plants at Kuala Lumpur have done well, but it is only with great care and attention that they are likely to prove a success.

Wild Gingers.—It appears from a report of the Royal Botanic Gardens, Kew, that a number of the Zingiberaceous plants are likely to prove valuable as paper making materials. *Hedychium coronarium*, it is stated, is superior in strength to the strongest Manila paper. A collection of Zingiberaceous plants were obtained from the jungle and planted at Kuala Lumpur, Batu Tiga and Gunong Angsi Government Plantations, under varying conditions. Those under partial shade have made the best growth. An experimental paper pulp plant is shortly to be installed at the Agricultural Department with which not only these but other wild paper making plants can be tested.

Cinchona.—The *Cinchona succirubra* and *C. ledgeriana* seeds received from Java in November of last year gave a good percentage of germination. Several acres have been planted up on Gunong Angsi.

Brazil nuts (*Bertholletia excelsa*). Several acres of this tree have been planted up at Kuala Lumpur.

Coffee.—Several acres of *Coffee canephora*, *C. Quillou*, *C. Uganda* and *C. Laurentii* have been planted.

Camphor (*Cinnamomum Camphora*).—The bushes at Kuala Lumpur and Batu Tiga have grown fairly well and have been more free from disease than in previous years. Seeds received from Formosa were as before unsatisfactory, giving about one per cent. germination. Some success has been obtained in propagating camphor by marcotting the small branches of the younger bushes.

Caravonica Silk Cotton.—Seeds were received from N. Queensland and germinated well, but the young seedlings all died off when about two inches high.

Fruits.—The collection of fruits has been considerably added to, among those received may be mentioned, Carabao Mango, *Terminalia edulis*, *Artocarpus odoratissima* and suckers of various bananas from the Director of Agriculture, Manila, *Anona Cherimolia* and *Spondias purpurea* from the Columbia Republic, and suckers of various pineapples from Mr. Davidson of Sarawak.

Roselle (*Hibiscus Sabdariffa*). This plant was introduced from the Phillipines and is being grown at Kuala Lumpur, where it has given satisfactory results. It is of some interest on account of its usefulness as a preserve and its wine making properties. A report on the subject by Mr. Lambourne was published in the *Agricultural Bulletin*.

Indigo.—The following varieties were experimented with at Kuala Lumpur and Castleton Estate. *Indigofera arrecta*, *I. sumatrana*, *I. hirsuta* and *I. Anil*. At the former place the plants were totally destroyed by the caterpillar of a moth, but at Castleton there was no appearance of this pest. So far the results as a whole have not proved satisfactory, and at present it is not deemed advisable to recommend its cultivation in Malaya. Further trials are to be made. A report on the subject has been prepared, and will shortly appear in the *Agricultural Bulletin*.

Nursery.—As in previous years, plants and seeds were distributed to a number of applicants in the Federated Malay States. Seeds were exchanged with a number of Colonial Departments.

GENERAL REMARKS.

About 20 acres of jungle land were cleared at Kuala Lumpur Experimental Plantation and all patches of lalang in the cultivated areas eradicated.

In the latter part of the year the Bukit Kutu Hill Gardens were placed under the control of the Agricultural Department. Kroh Gardens, Upper Perak, were visited about the middle of the year.

A considerable number of economic plants in addition to those mentioned in this report have been introduced and are being experimented with.

High Commissioner's New Lodge.—The laying out of these grounds was completed in the latter part of the year. Considerable expense was incurred on turfing slopes near the house and in the preparation of flower beds. The soil, on the whole, is of a poor laterite nature, and in order to render it suitable for plant growth, large applications of humus soils, and manures were necessary. Isolated specimens of palms, trees and shrubs were planted in various parts of the grounds. A considerable number of beds were opened up and annuals planted, these have made a good show during the year. The tennis courts have been maintained in good condition by occasional top dressings of jungle soil and manures.

Chief Secretary's Grounds.—These grounds have been maintained in good condition throughout the year.

The tennis courts have received several applications of jungle mould and artificial manures. Over grown shrubs in a number of beds were taken out, the land manured, and young plants put in.

The pot plants have been maintained in good condition. A small white mealy bug was troublesome among the maiden hair ferns, but was kept under by frequent sprayings with water. The vegetable garden has been kept fairly well stocked.

CASTLETON ESTATE.

The experimental work on this estate has already been referred to.

Mr G. E. Jones was in immediate charge during the year. The Agriculturist visited the estate periodically.

The erection of the rubber factory, drying house, store and office was commenced about the middle of the year, it is intended that this shall serve as a model building and particular attention has been paid to labour saving ideas and to the proper planning of the building. The construction of a set of permanent cooly lines commenced in the latter part of the year.

The roads and drains have been maintained in good repair. A number of substantial foot bridges were erected.

LABOUR.—The labour consists of Malays, Javanese and Tamils. The health of the coolies has been exceptionally good.

TAPPING.—This was commenced on the 17th March on 4,609 trees and on the 10th of November an additional 2,751 trees were included, covering in all, roughly, 56 acres. The total area of the estate is 207 acres. Tapping is conducted every day on a single "V." This work has been well supervised, the trees being remarkably free from wounds. Owing to the Castleton factory being in the course of erection the rubber was prepared at Cicely Estate. Fine crepe has been manufactured and excellent prices have been obtained. Weeding has been well attended to, the whole area being entirely free from lalang and other noxious weeds. The estate was weeded on an average twice a month with the exception of plots under green manures.

Generally speaking, the trees are very healthy in appearance and free from insect attacks and fungoid disease. About the middle of the year a few trees were attacked by pink disease, but this pest was kept well in hand; at the close of the year there was no sign of its reappearance.

The young rubber has shown very good growth, the average increase in circumference 3 feet from the ground, varying from 5 inches in some fields to $5\frac{1}{2}$ inches in others.

The uprooting of stumps and burning of timber on an 11-acre block of land surrounding the new buildings was completed in the early part of the year. This area was also drained and planted up with coconuts.

The following statement shows the expenditure and revenue of the estate during the year:

Upkeep Expenditure—	
The entire cost of maintenance of the whole estate inclusive of all revenue expenditure	$15,211.88
Capital Expenditure—	
Advances on buildings in course of erection	17,150.00
Total expenditure ...	$32,361.88
Revenue Account—	
By net proceeds of sale of 8,890 lbs. of rubber	$ 7,822.17
By value of unsold stock at prices since realized	3,574.52
By Bank interest earned	64.23
Total revenue ...	$11,460.92

Nothing has been entered in upkeep expenditure for a visiting agent and if a sum of $50 per month were allowed for the above $600 would require to be added to upkeep expenditure.

The balance sheet as at 31st December, 1913, stands as follows:

CASTLETON ESTATE.

BALANCE SHEET AS AT 31ST DECEMBER, 1913.

LIABILITIES.			ASSETS.		
	$ cts.	$ cts.		$ cts.	$ cts.
To Government loan ...	95,158 35		By Property—		
„ Less amount repaid ...	7,822 17		Loan at time Property fell in	16,400 00	
		87,336 18	Additional land purchased...	320 00	
„ Sundry Creditors—			Cost of transfer fee, etc.	200 25	
Coolies wages December	753 35				16,920 25
Wong Yeak	171 00		„ Development and maintenance—		
C. E. Jones	20 93		Previously to 31st December, 1912	31,252 98	
Cicely Rubber Co., Ltd.	581 25		During 1913 including all rubber—		
		1,526 53	Revenue Expenditure $15,211.88		
			Less Revenue 11,460.92	3,750 96	
					35,003 94
			„ Buildings—		
			Previously to 31st December, 1912	1,096 12	
			During 1913	17,150 00	
					18,246 12
			„ Water Service	...	405 50
			„ Rubber stock lbs. 3,768 (at prices since realized)	...	3,574 52
			„ Cash in Bank	...	14,712 38
		88,862 71			88,862 71

GOVERNMENT PLANTATION, PONDOK TANJONG.

The Government Plantation, Pondok Tanjong, has been in charge of Mr. W. L. Swan, throughout the year.

WEEDING.—The cost per acre per year was $11.63; the weeding in the immature area is heavy and also those parts of the old area which were badly affected by floods during the wet season; the cost of some cultivation is included in the figure.

TAPPING.—Two hundred and thirty-two and-a half acres were tapped during the year, the bark renewal in some parts is very bad. In all 84,729½ lbs. of rubber were collected at a cost of $29,322.65, which works out at cents 34.80 per lb., f. o. b., Pondok Tanjong Railway Station. The cost of railway freight to Penang and duty on rubber are not included in this figure. This crop after deducting auctioneers' fees, railway freight, cost of creping bark shavings realized $72,793.66.

Sale of rubber seeds and stumps realized	$ 1,135.80
Sale of rubber realized	72,793.66
Total amount realized ...	$73,929.46

which shows a profit of $44,606.81 on the revenue expenditure, and a profit of $33,505.94 on the total expenditure. The average yield per acre was 362 lbs. during the year.

PESTS.—Branch disease was prevalent and was treated continually throughout the year. Root disease and white ants were also treated.

EXPENDITURE—

The revenue expenditure amounts to	$29,322.65
The capital expenditure amounts to	11,100.87
Total expenditure ...	$40,423.52

REVENUE—

Revenue by sale of rubber amounted to	$72,793.66
Revenue by seeds and stumps amounted to	1,135.80
Rebate on assessment	72.00
Total revenue ...	$74,001.46

In reckoning the profit I have not counted $72 rebate on assessment.

BUILDINGS.—A bungalow for the Manager was erected.

LABOUR FORCE.—The labour force on 31st December was as follows :

Tamils	125
Malays	88
Bengalese	3
Siamese	2
Chinese	1
Total ...	219

HEALTH.—The health of the labour force is fair, though mild cases of fever were somewhat prevalent. There were 52 admissions to the hospital. There were four deaths on the estate during the year (one adult and three children).

RAINFALL.—Total rainfall for the year was 177.23 inches.

GOVERNMENT GARDENS, MAXWELL'S HILL AND PUBLIC GARDENS, TAIPING.

The actual expenditure on the Maxwell's Hill Gardens for the year was $9,973.25 and the total revenue from hill produce was $2,668.07, a slight decrease on 1912. The revenue from vegetables and flowers was $1,945.64, a slight increase on the preceding year.

There was a slight difficulty during the early part of the year in maintaining the labour supply on the hill and some coolies were recruited from India. At the end of the year labour was abundant. There is very little sickness among the labourers, and this is mainly slight colds and coughs.

A good supply of vegetables was maintained throughout the year. Unfortunately, the glass frames provided for were not completed during the year, it is expected that these will enable vegetables to be grown even during the wettest months. New varieties of roses were introduced from England and are doing well. The violets are maintained from the old stock and show no sign of deterioration.

The cattle herd was maintained, the milking cows, etc., on the hill and the balance mostly in Taiping. The scanty hill pasturage is thus conserved; about 10 acres of Guinea grass is now upkept on the hill.

The Public Gardens, Taiping, have been well maintained and several improvements, both in the gardens themselves and in the buildings, etc., have been carried out and others started.

Mr. Wood also has charge of the Residency Grounds at Taiping and Ipoh.

GENERAL.

A number of other minor investigations were carried on in the laboratories, of which only brief mention can be made here. The results when of general interest are published in the *Agricultural Bulletin*. A sample of oil seeds stated to be from a forest climbing plant was received from the Conservator of Forests for examination. These proved to be seeds of *Hodgsonia heteroclita*, yielding an oil known as Kapayang oil, a semi-solid fat at the normal temperature in this country, but which would be solid in a temperate climate. The yield of oil from the decorticated seed was 59.4 per cent. The oil could probably be utilized if seed were obtainable in quantity.

A sample of lalang fibre prepared by treating *Imperata arundinacea* with caustic alkali was received for examination. The cellulose content of the sample was only 57.1 per cent., which was very low in view of its previous treatment.

A die back disease of *Hibiscus* which is somewhat prevalent in this country was investigated. Mycological experiments point to a species of *Fusarium* as the cause of the disease.

Other mycological work was carried out by Mr. Bateson upon a disease of Angsana, (*Pterocarpus indicus*). This disease is a very serious one in parts of the Federated Malay States and it is killing out many fine trees in Kuala Lumpur, Taiping and other places. The work was unfinished at the end of the year, but further investigation is proceeding. Mr. Bateson brought out an interesting theory to account for the formation of a certain type of burr on rubber trees. More work is necessary before any definite statement can be made on this subject.

Mr. Holman-Hunt, Assistant Entomologist, has been given charge of part of the department's collection of Malayan insects. While in London he will endeavour to get these identified and named. It is expected that several of the forms will prove to be new.

Our experiments and laboratory work have proved of great practical value to estates, which are of course more anxious than ever to adopt the best methods. Planters, especially in Perak, have not been slow to take advantage of the opportunities afforded them through the Agricultural Inspectors of obtaining advice and assistance and their co-operation is essential to the successful working of this new division.

The *Agricultural Bulletin* continues to prove its value both to Planters and the department and the arrangement whereby this remains the official organ of the Planters' Association of Malay and the Department of Agriculture has been continued.

Tables of statistics of estate cultivations are appended.

L. LEWTON-BRAIN,
Director of Agriculture, F.M.S.

Table I.

Agricultural Acreages in the Federated Malay States, 1912 and 1913, excluding Padi and Horticulture from Estates over 100 acres in Extent.

	Selangor.		Perak.		Negri Sembilan.		Pahang.		Total.	
	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.
Coconuts	7,916	11,320	20,329	24,611	571	1,892	1,492	2,352	30,308	40,175
Rubber	170,843	194,946	140,287	142,649	78,564	85,806	9,503	9,923	399,197	433,324
Coffee	5,559	5,929	2,988	1,696	2	10	60	60	8,609	7,695
Other cultivations ...	1,787	1,721	583	898	696	1,013	2	501	3,068	4,133
Total ...	186,105	213,916	164,187	169,854	79,833	88,721	11,057	12,836	441,182	485,327

Table II.

Agricultural Acreages, Malaya, 1913, from Estates over 100 acres in Extent.

	Federated Malay States.	Straits Settlements.	Johore.	Kelantan and Kedah.	Trengganu.	Grand Total.
Rubber alone ...	422,433	102,152	114,116	42,502	1,410	682,613
,, and coffee ...	4,906	...	...	550	...	5,456
,, ,, coconuts	1,935	794	...	376	...	3,105
,, ,, sugar ...						
,, with other crops	4,050	8,370	2,906	1,945	100	17,371
Total ...	433,324	111,316	117,022	45,373	1,510	708,545
Coconut alone ...	35,265	20,433	679	14,610	4,291	75,278
,, and coffee ...	2,597	...	...	...	...	2,597
,, with other crops exclusive of coffee ...	2,313	2,961	216	376	100	5,966
Total ...	40,175	23,394	895	14,986	4,391	83,841
Coffee alone	192	...	30	500	...	722
,, with other crops	7,503	...	...	550	...	8,053
Total ...	7,695	...	30	1,050	...	8,775
Sugar alone	...	7	...	...	...	7
,, with other crops						
Total ...	...	7	...	...	...	7

Table III.

Rubber Statistics, Federated Malay States, up to the 31st December, 1912 and 1913 from Estates over 100 acres in Extent.

—	Selangor.		Perak.		Negri Sembilan.		Pahang.		Total.	
	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.
No. of estates	258	273	288	297	133	140	24	24	703	734
Acreage in possession ...	313,142	337,957	290,294	300,114	152,338	153,462	38,771	39,145	794,545	830,678
Acreage planted up to 31st December, 1912 and 1913	170,843	194,946	140,287	142,649	78,564	85,806	9,503	9,923	399,197	433,324
Rubber alone	161,667	189,331	135,105	138,974	77,835	84,765	8,951	9,363	383,558	422,433
Rubber interplanted with catch-crop	9,176	5,615	5,182	3,675	729	1,041	552	560	15,639	10,891
Acreage producing ...	69,350	86,888	42,818	48,765	22,840	26,578	1,116	2,159	136,124	164,390
Planted during 1912 and 1913	24,534	24,103	16,334	2,362	11,927	7,242	1,310	420	54,105	34,127

Table IV.

Rubber Statistics, Malaya, up to the 31st December, 1912 and 1913, from Estates over 100 acres in Extent.

—	Federated Malay States.		Straits Settlements.		Johore.		Kelantan and Kedah.		Trengganu.		Total.	
	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.
No. of estates ...	703	734	181	196	68	113	95	100	8	8	1,055	1,151
Acreage in possession ...	794,545	830,678	207,199	224,560	283,409	344,203	190,980	197,184	22,149	25,606	1,498,282	1,622,231
Acreage planted up to 31st December, 1912 and 1913 ...	399,197	433,324	94,263	111,316	91,827	117,022	34,837	45,373	1,497	1,510	621,621	708,545
Rubber alone ...	383,558	422,433	85,949	102,152	87,729	114,116	30,499	42,502	139	1,410	587,874	682,613
Rubber interplanted with catch-crop ...	15,639	10,891	8,314	9,164	4,098	2,906	4,339	2,871	1,358	100	33,748	25,932
Acreage producing ...	136,124	164,290	16,717	29,849	11,153	15,868	1,572	3,452	...	...	165,566	213,459
Planted during 1912 and 1913	54,105	34,127	6,600	17,053	17,200	25,195	7,201	10,536	797	13	85,903	86,924

Table V.

Comparative Table of Rubber Crops, Malaya, 1906 to 1913.

State.	1906.		1907.		1908.		1909.		1910.		1911.		1912.*a*		1913.*a*	
	Tons.	cwt.	Tons.	cwt.	Tons.	cwt.	Tons.	cwt.	Tons.	cwt.	Tons.	cwt.	Tons.	cwt.	Tons.	cwt.
Selangor	276	16	504	19	824	6	1,641	5	3,148	13	5,106	14	7,482	6	10,110	15
Perak	42	7	121	16	171	0	473	9	1,322	8	2,697	4	4,116	18	6,623	17
Negri Sembilan ...	65	12	262	0	430	0	601	2	1,160	12	1,918	12	2,518	16	3,339	16
Pahang	...		...		...		...		* 1	2	13	18	74	14	155	9
Malacca	† 5	7	10	10	23	13	* 16	9	267	16	382	11	1,742	6	3,549	2
Province Wellesley ...	† 6	1	36	13	41	7	131	1	198	19	571	15	1,973	16	2,498	12
Johore	21	6	81	9	90	0	146	5	296	12	404	2	968	6	1,645	7
Kelantan and Kedah ...	...		...		...		...		18	11	23	0	79	6	246	18
Trengganu																
Total ...	417	9	1,017	7	1,580	6	3,009	11	6,414	13	11,117	16	18,956	8	28,169	16

In Province Wellesley are included thirty-one estates in Singapore, twenty-four estates in Penang and eight estates in Dindings.

† These figures are approximate.

* This is the figure returned, but the actual output was a good deal higher.

a Figures are from estates over 100 acres in extent.

Table VI.

Estate Labour, Federated Malay States, 1913, from Estates over 100 acres in Extent.

Race.	Selangor.	Perak.	Negri Sembilan.	Pahang.	Total.
Tamil men	51,061	34,750	8,952	2,750	97,513
,, women	25,142	13,586	3,190	553	42,471
Javanese men	2,765	4,600	2,269	633	10,267
,, women	563	3,048	322	337	4,270
Malays	1,347	5,609	1,537	539	9,032
Chinese	6,026	9,810	17,002	3,777	36,615
Others	206	405	300	128	1,039
Labour Total ...	87,110	71,808	33,572	8,717	201,207

Table VII.

Estate Labour, Malaya, 1913, from Estates over 100 acres in Extent.

Race.	Federated Malay States.	Straits Settlements.	Johore.	Kelantan and Kedah.	Trengganu.	Total.
Tamil men	97,513	9,934	4,321	2,912	...	114,680
,, women ...	42,471	3,518	1,027	1,036	...	48,052
Javanese men ...	10,267	2,681	4,934	366	2	18,250
,, women ...	4,270	1,324	541	185	...	6,320
Malays	9,032	4,742	1,003	2,206	390	17,373
Chinese	36,615	11,891	21,208	4,960	467	75,141
Others	1,039	889	566	42	2	2,538
Labour Total ...	201,207	34,979	33,600	11,707	861	282,354